

# Real-time NLDAS System

## - An Upgrade from Current OPS NLDAS-2 System

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Kenneth E. Mitchell**

**14 July 2016**

**Acknowledgement: Ying Lin and Eric Rodgers from EMC, and David Mocko, Sujay Kumar, and Christa Peters-Lidard from NASA/GSFC**

# Bug Fix Issues

a. What NDAS precipitation should be used?

**APCP vs LSPA**

b. What NAM forecast product should be used?

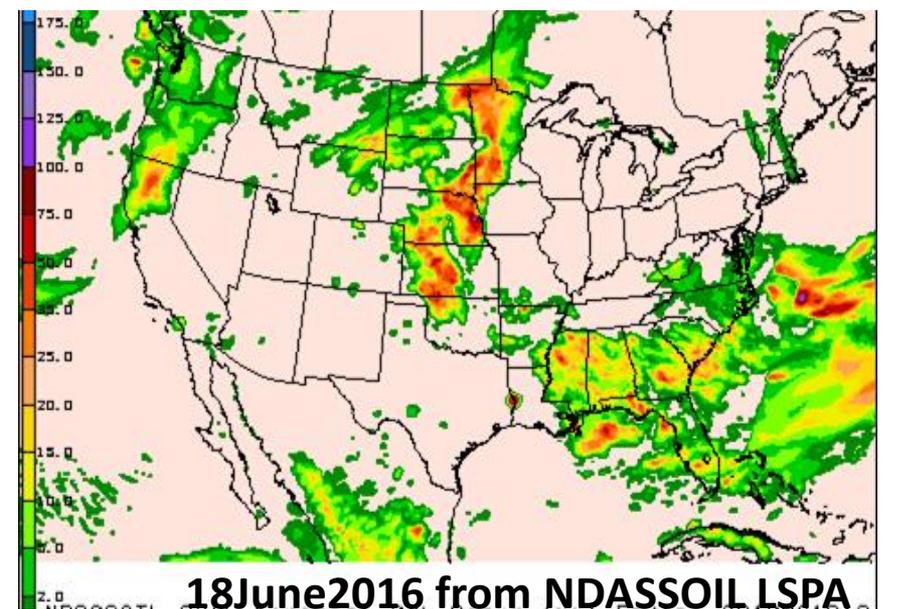
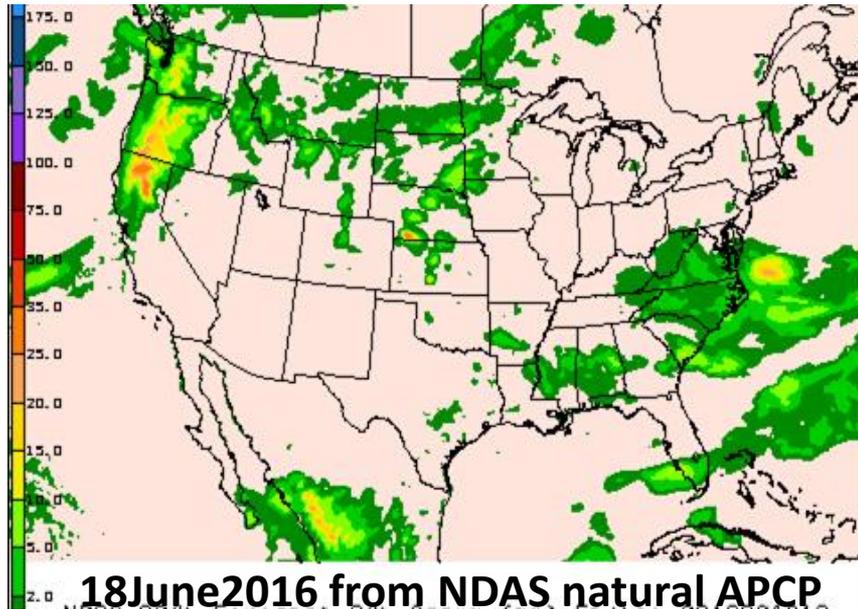
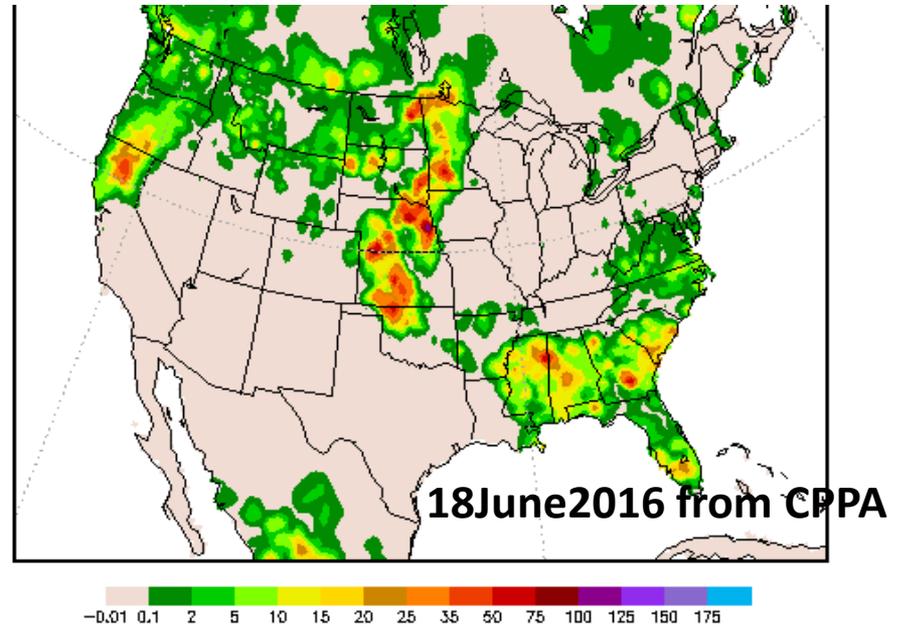
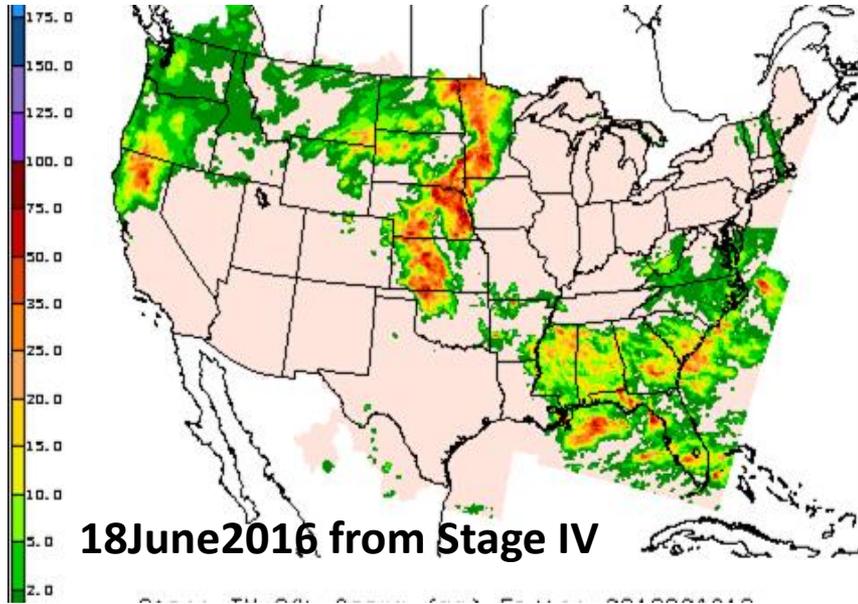
**12Z run Cycle 0-24hr forecast vs 00Z run cycle 15-36hr forecast**

c. What should be solved for NAM precipitation bucket?

IN THE CASE OF NAM PRECIPITATION, FOR 00Z NAM CYCLE 15-36 HOUR FORECAST, THE ACCUMULATION PERIOD IS 15HR (12Z-15Z), 18HR(12Z-18Z), 21HR(12-21Z), 24HR(12Z-00Z) TODAY, AND 27HR(00-03Z), 30HR(00-06Z), 33HR(00-09Z), 36HR(00-12Z) TOMORROW. THE PRECIPITATION NEEDS TO GET 3-HOURLY TOTAL FIRST.

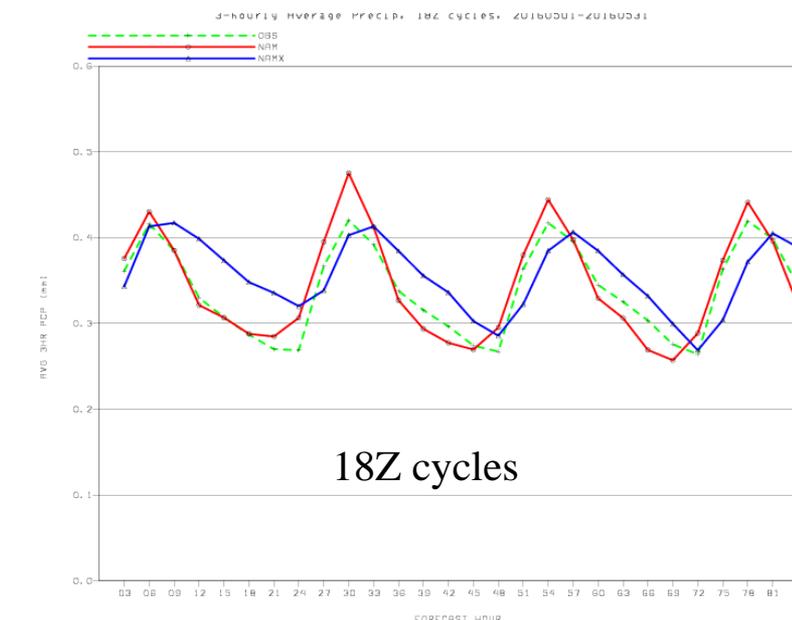
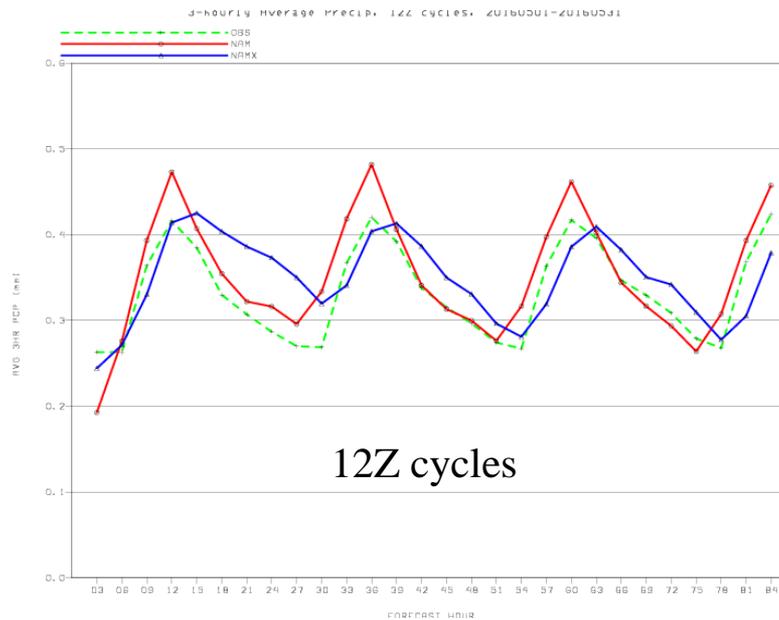
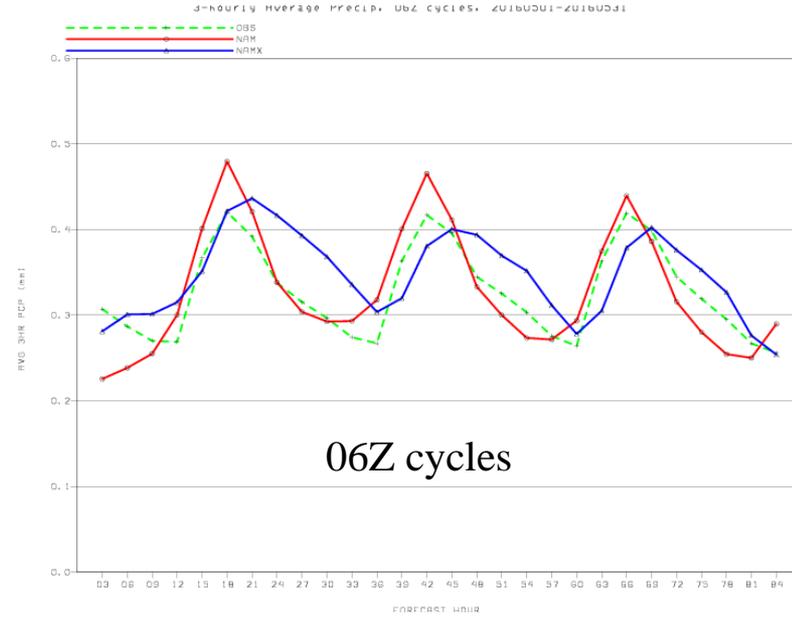
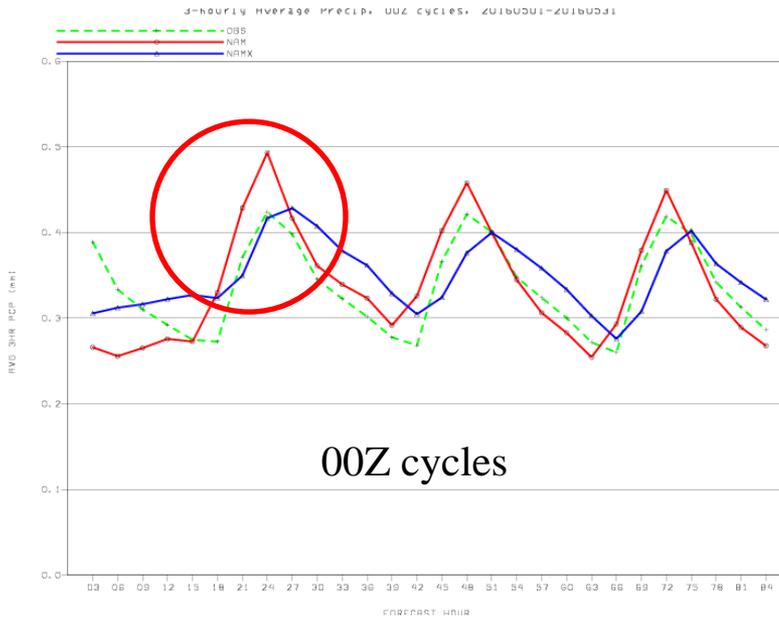
**Thank Ying Lin who provided next three slides**

# Difference between natural NDAS pcp and LSPA ("NDASSOIL")

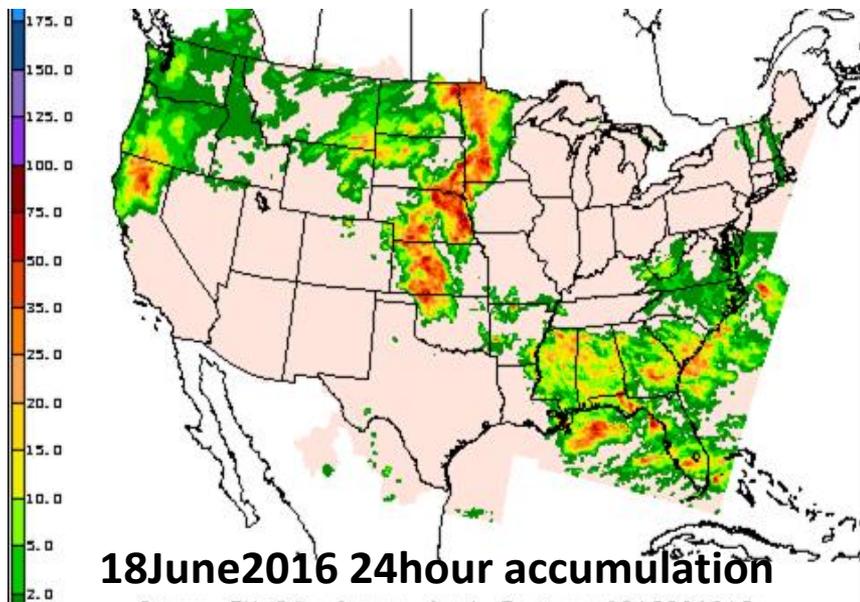


Gauge-based bias-corrected stage IV

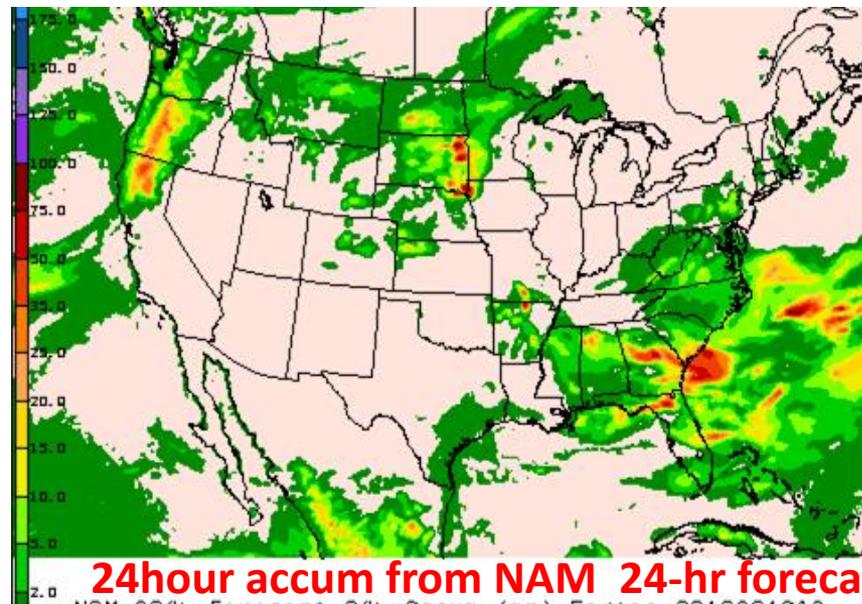
# ConUS-averaged 3-hrly pcp, NAM/NAMX/CCPA, May 2016



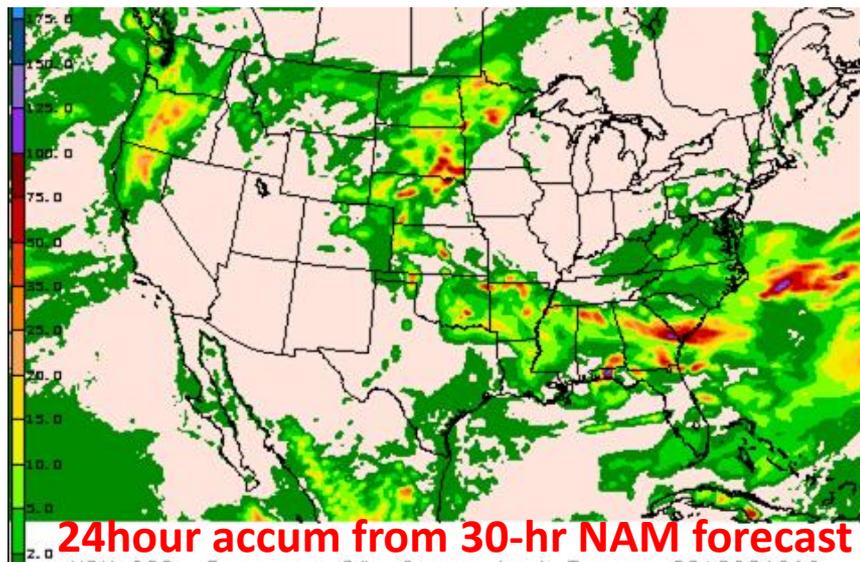
# An example of dry initial NAM fcst



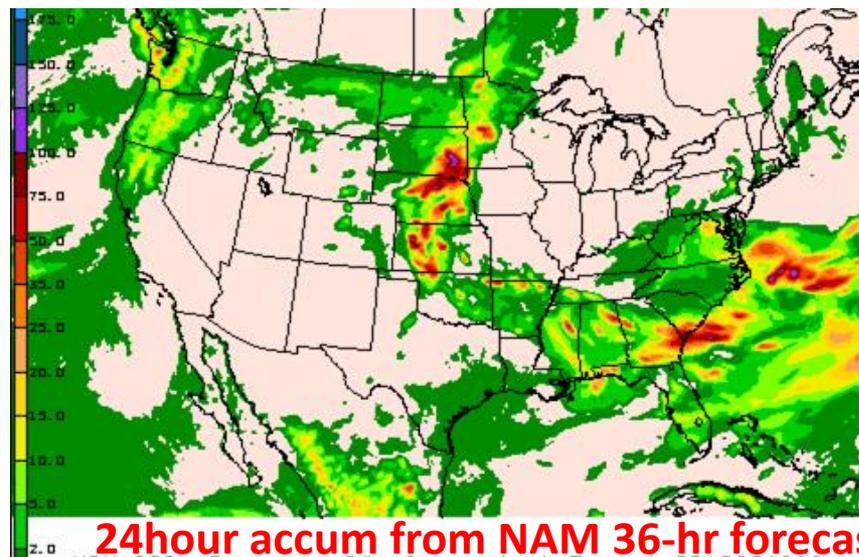
**18June2016 24hour accumulation  
from Stage IV ending 2016061812**



**24hour accum from NAM 24-hr forecast  
ending 2016061812**



**24hour accum from 30-hr NAM forecast  
ending 2016061812**

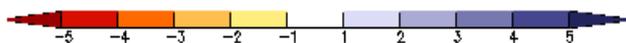
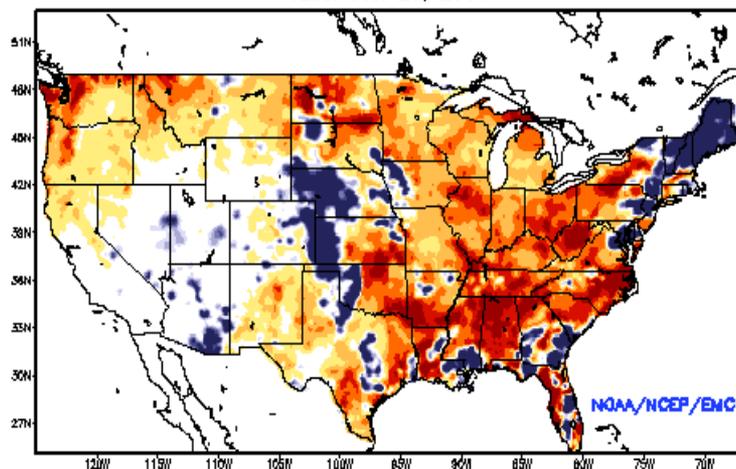


**24hour accum from NAM 36-hr forecast  
ending 2016061812**

# Comparison analysis for new run when bugs are fixed

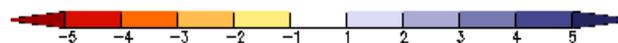
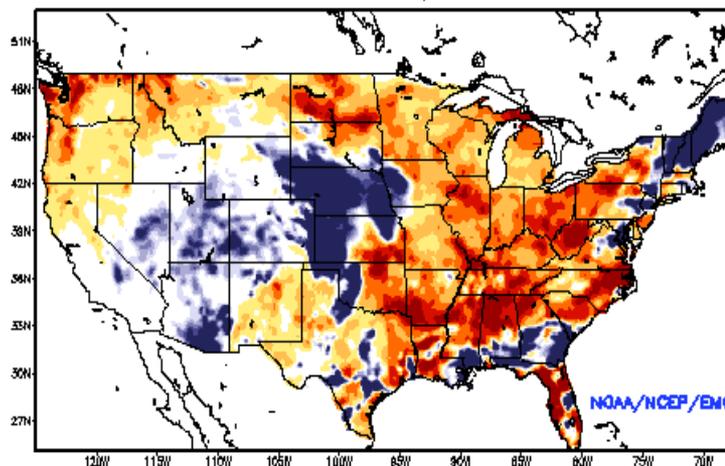
## OPS

NLDAS - Current Precipitation Anomaly (mm/day)  
Valid: JUN 29, 2018

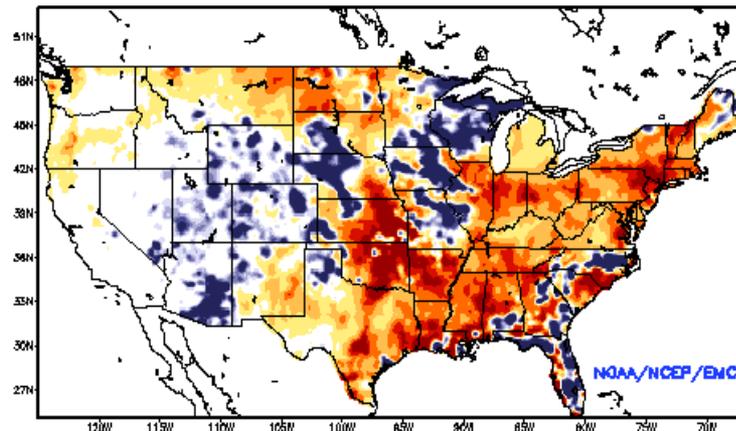


## Test

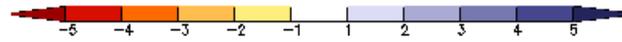
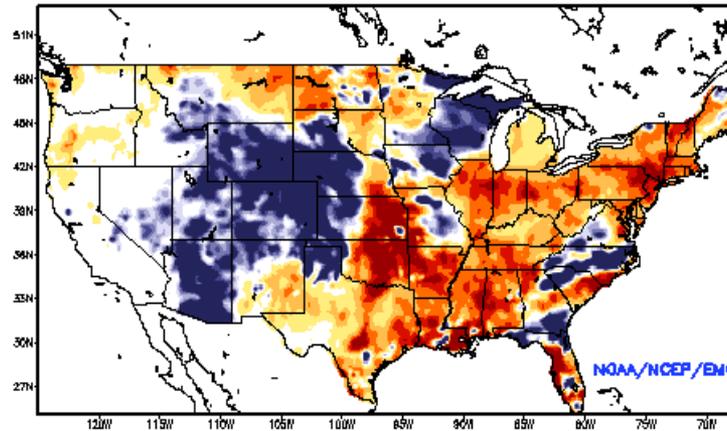
NLDAS - Current Precipitation Anomaly (mm/day)  
Valid: JUN 29, 2018



NLDAS - Current Precipitation Anomaly (mm/day)  
Valid: JUN 30, 2018

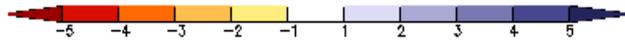
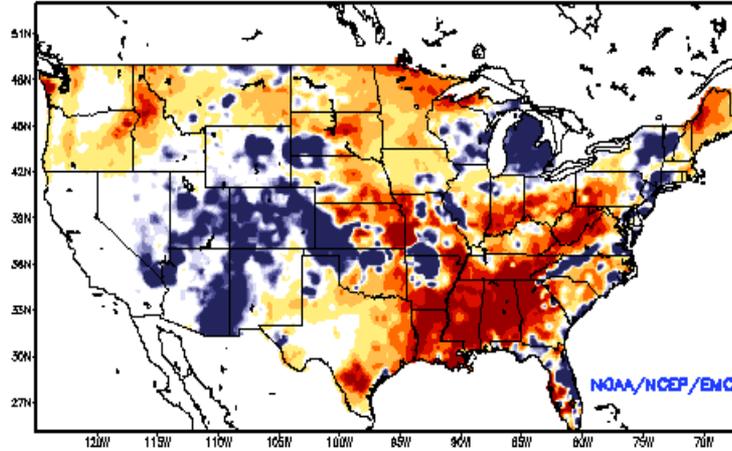


NLDAS - Current Precipitation Anomaly (mm/day)  
Valid: JUN 30, 2018



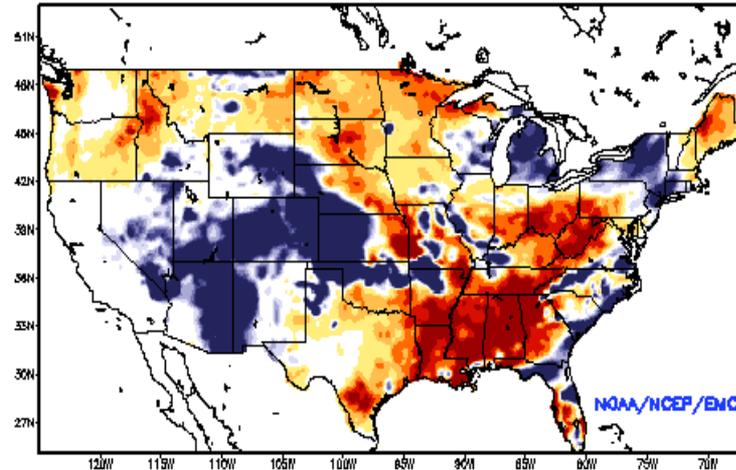
# OPS

NLDAS - Current Precipitation Anomaly (mm/day)  
Valid: JUL 01, 2018

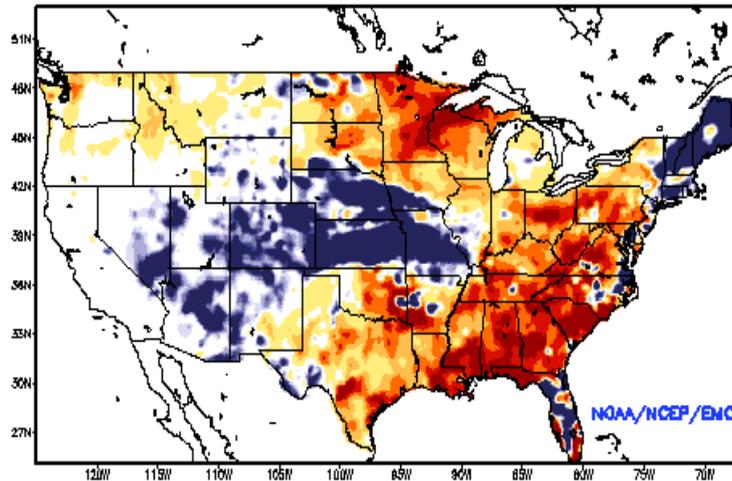


# Test

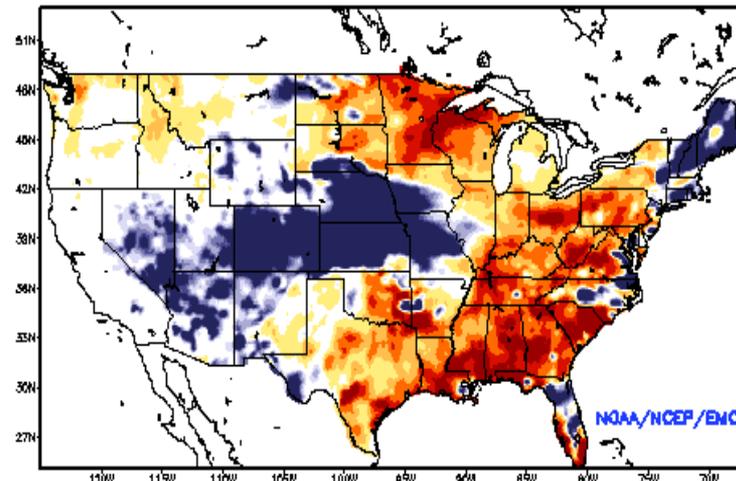
NLDAS - Current Precipitation Anomaly (mm/day)  
Valid: JUL 01, 2018



NLDAS - Current Precipitation Anomaly (mm/day)  
Valid: JUL 02, 2018



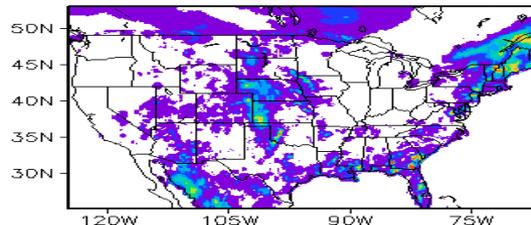
NLDAS - Current Precipitation Anomaly (mm/day)  
Valid: JUL 02, 2018



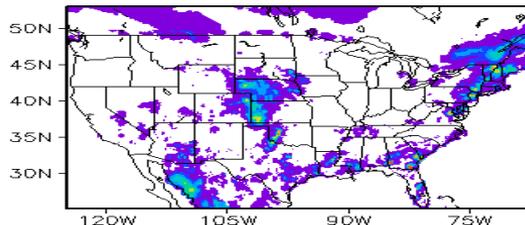
# Precipitation comparison

29 June 2016

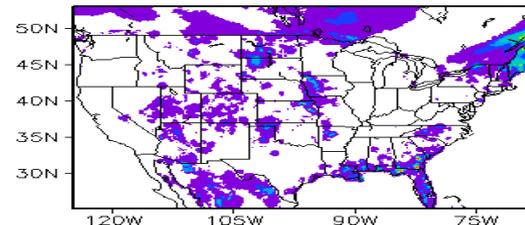
(a) ops(0-23Z)



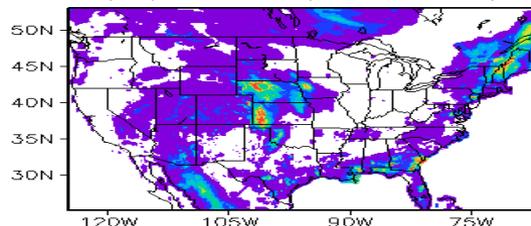
(b) ops(0-11Z)



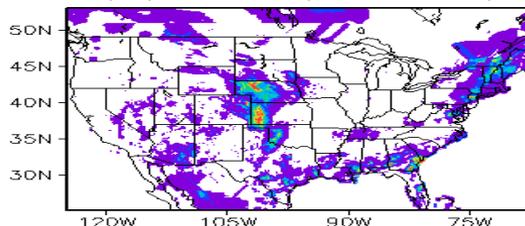
(c) ops(12-23Z)



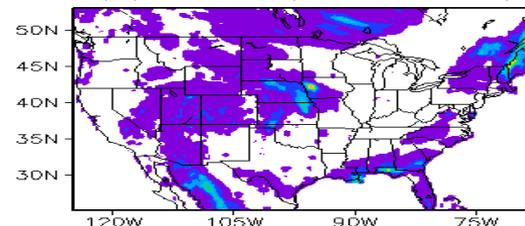
(d) test(0-23Z)



(e) test(0-11Z)

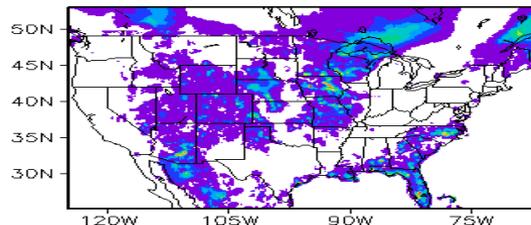


(f) test(12-23Z)

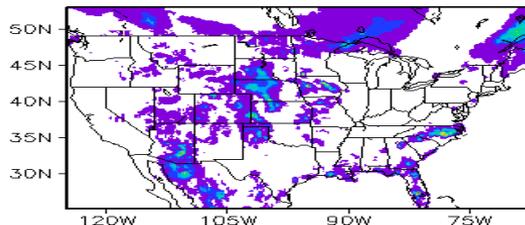


30 June 2016

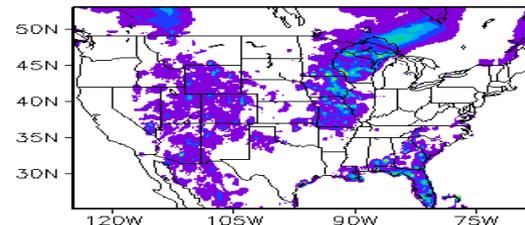
(a) ops(0-23Z)



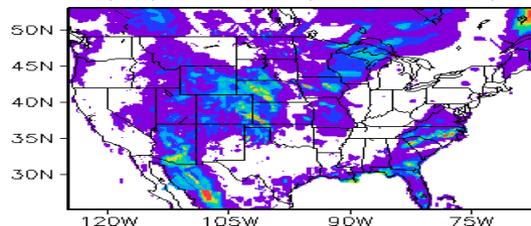
(b) ops(0-11Z)



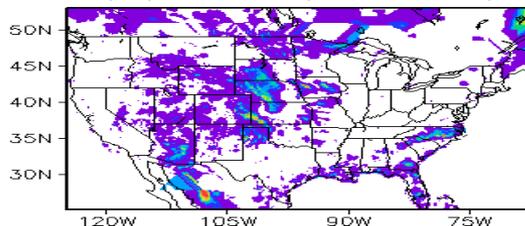
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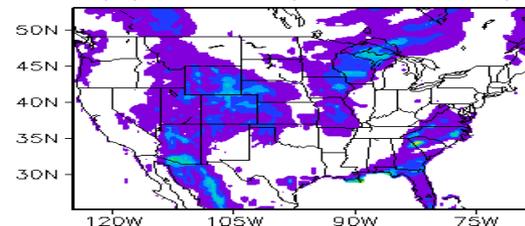
(d) test(0-23Z)



(e) test(0-11Z)



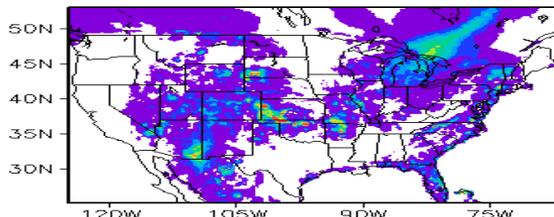
(f) test(12-23Z)



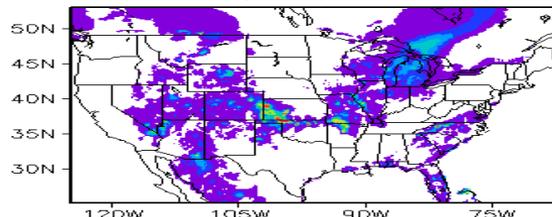
# Precipitation Comparison (continue)

## 1 July 2016

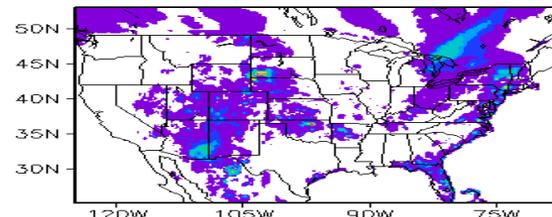
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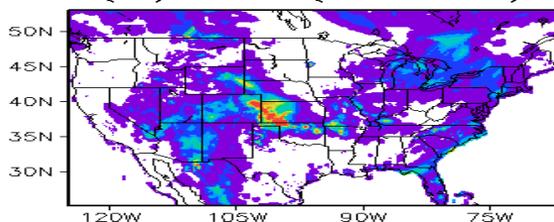
(b) ops(0-11Z)



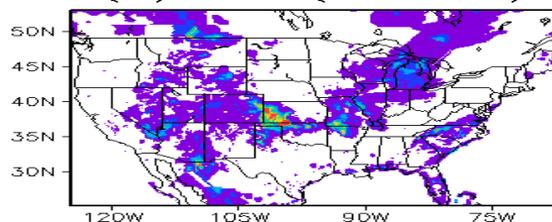
(c) ops(12-23Z)



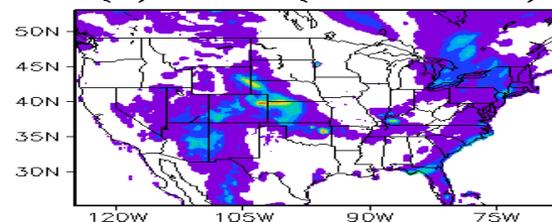
(d) test(0-23Z)



(e) test(0-11Z)

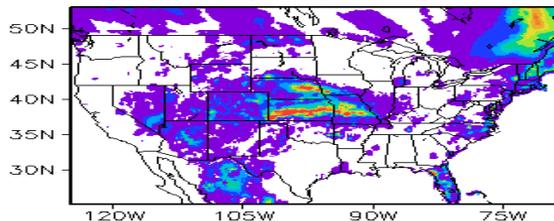


(f) test(12-23Z)

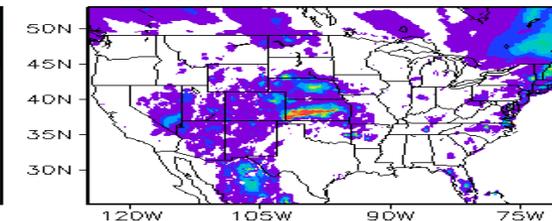


## 2 July 2016

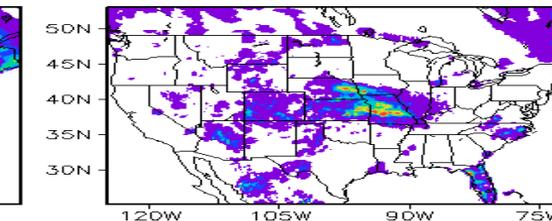
(a) ops(0-23Z)



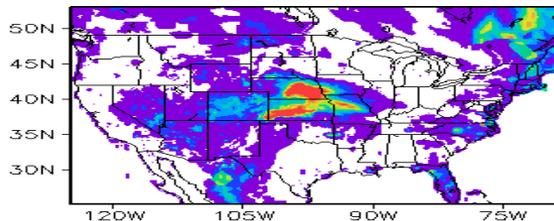
(b) ops(0-11Z)



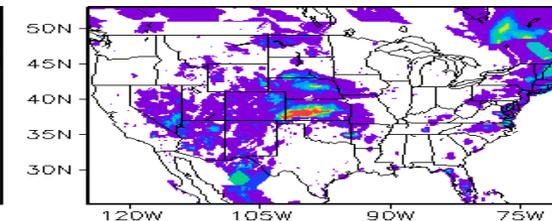
(c) ops(12-23Z)



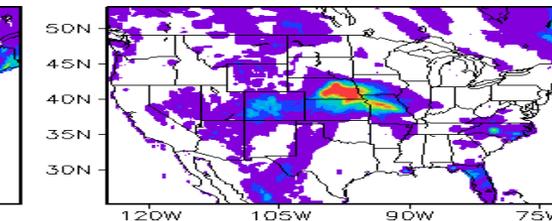
(d) test(0-23Z)



(e) test(0-11Z)



(f) test(12-23Z)



# Difference of Soil Moisture (volumetric) between Test and OPS

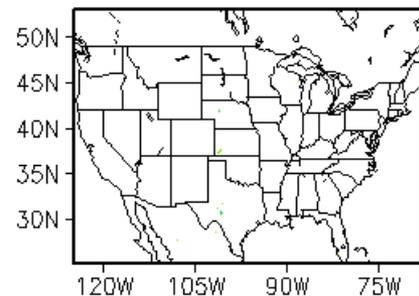
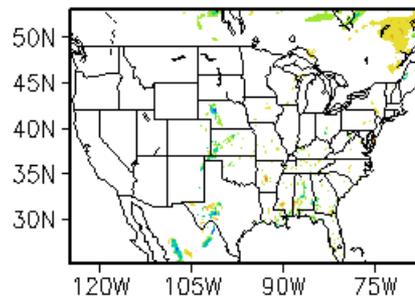
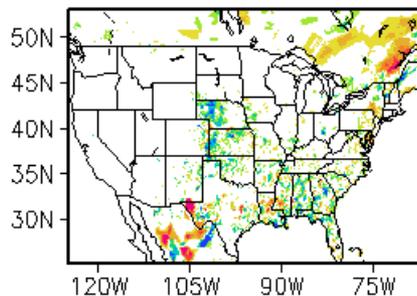
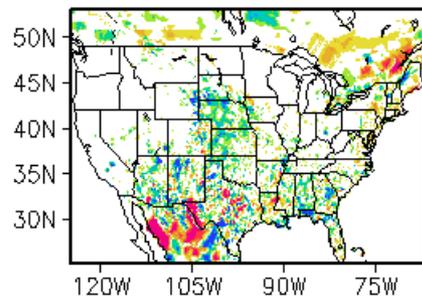
SM1

SM2

SM3

SM4

29JUN



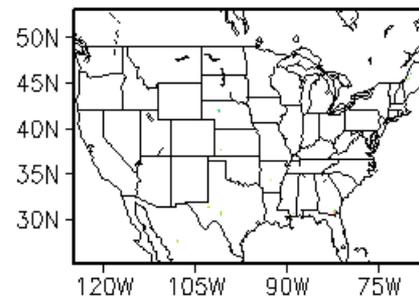
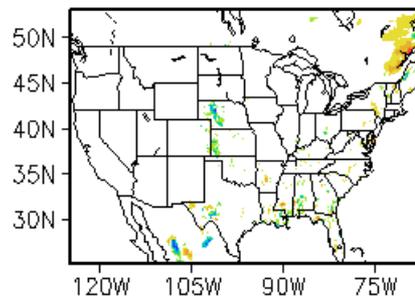
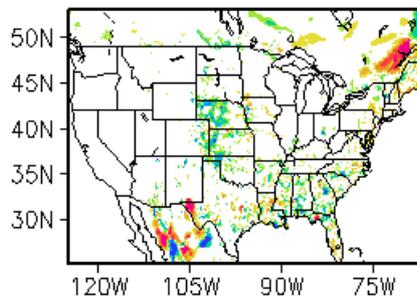
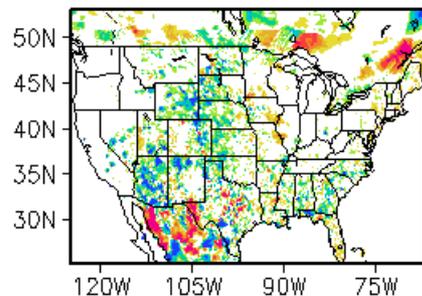
SM1

SM2

SM3

SM4

30JUN



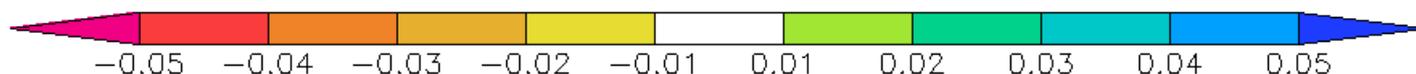
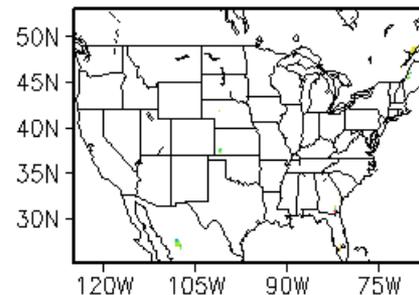
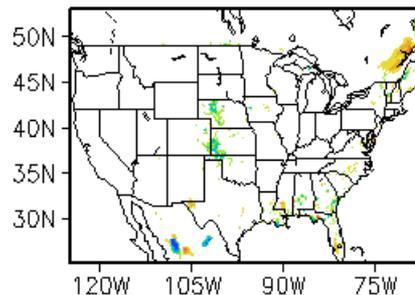
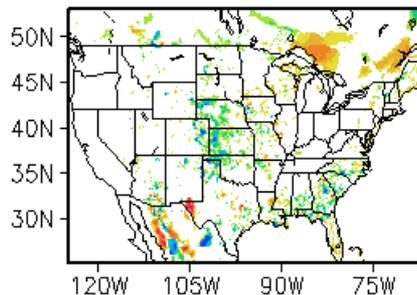
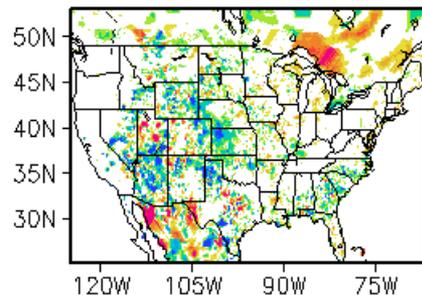
SM1

SM2

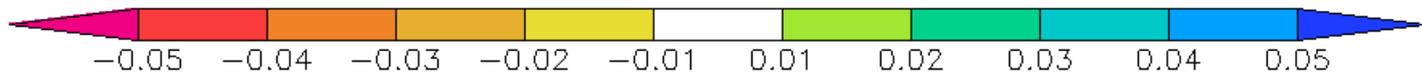
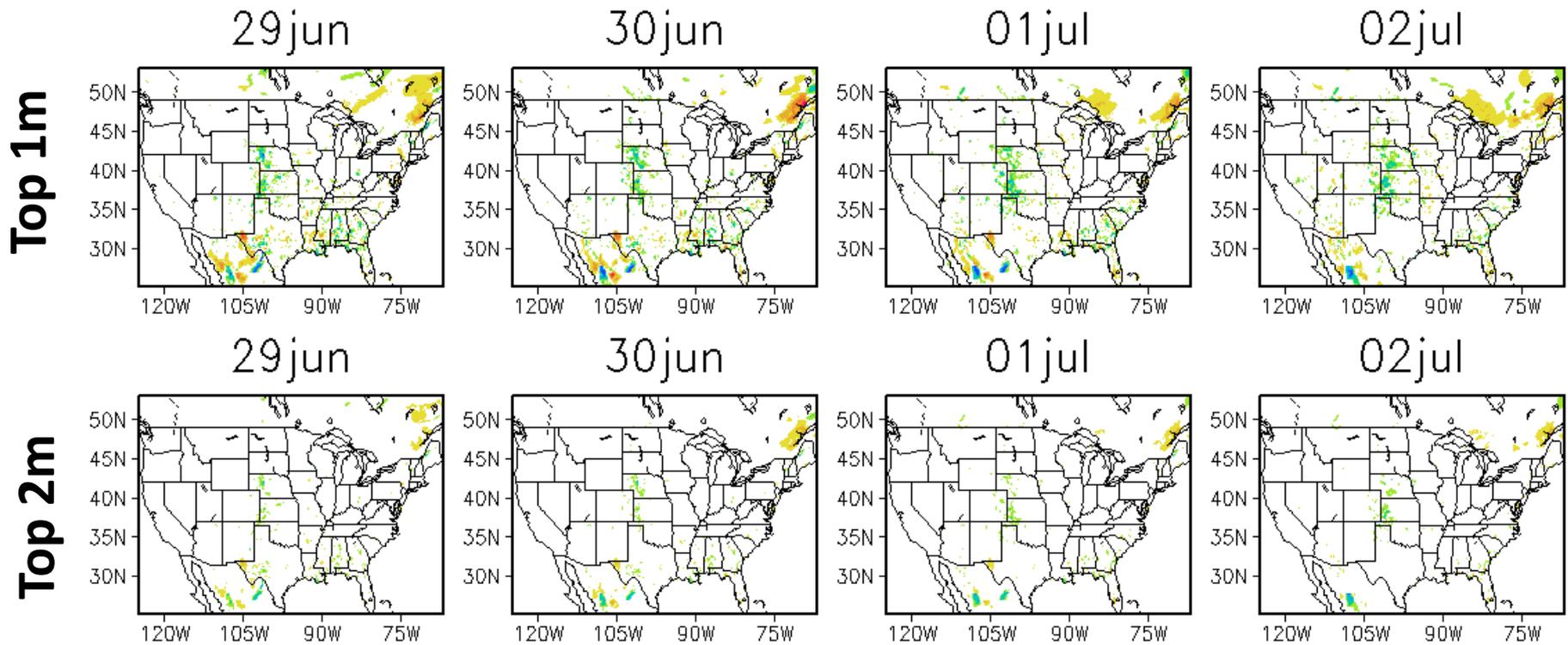
SM3

SM4

02JUL



# Difference of top 1m and 2m soil moisture (volumetric) between Test and OPS



# Possible reasons for the differences of soil moisture

For 4-day gap, these differences from forcings can have:

- a. precipitation: NDAS precipitation, stage II precipitation, NAM forecast and CPC gauge precipitation . CPC gauge precipitation was re-processed after three days when more gauges are included.
- b. Radiation: Bias-corrected NARR for OPS. GOES downward direct insertion, NDAS and NAM radiation
- c. The other forcings: NARR vs NDAS/NAM

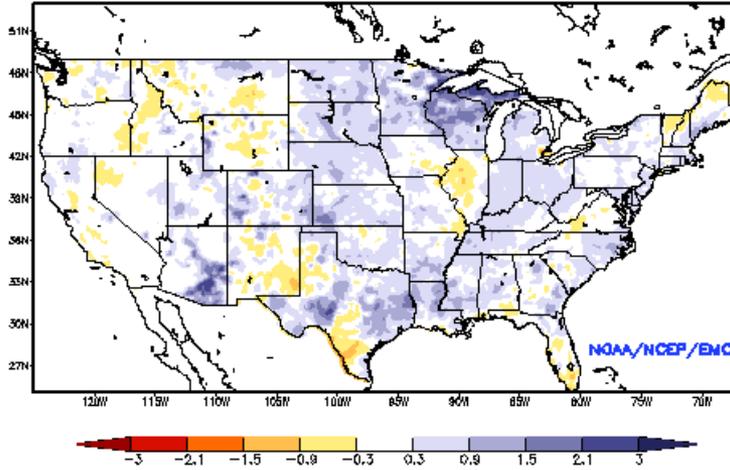
Nevertheless, the effect on soil moisture in this test may be small. However, the effect on ET in summer is large. The effect on Q in summer is intermediate. As expected, it may draw a reverse conclusion in winter.

# Daily Evaporation Comparison

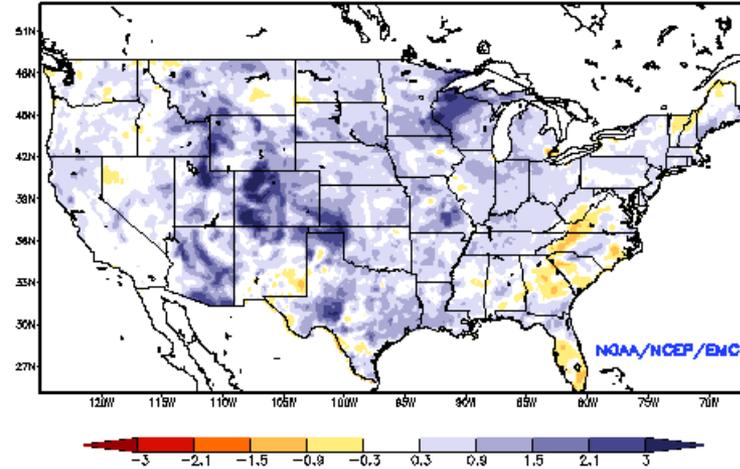
## OPS

## Test

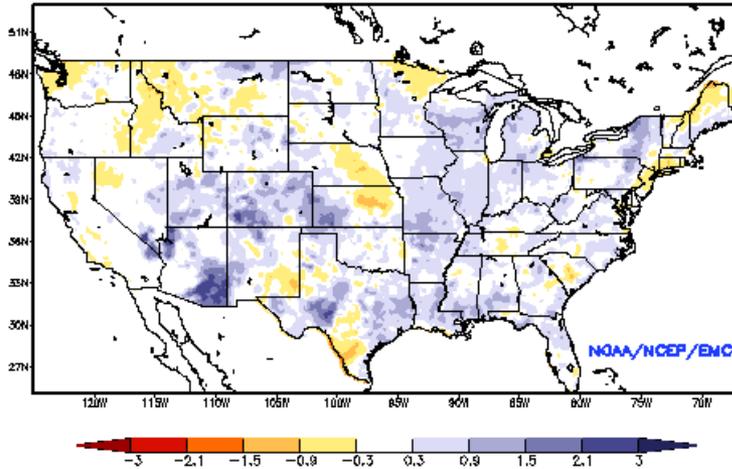
NCEP Noah - Current Evaporation Anomaly (mm/day)  
Valid: JUN 30, 2018



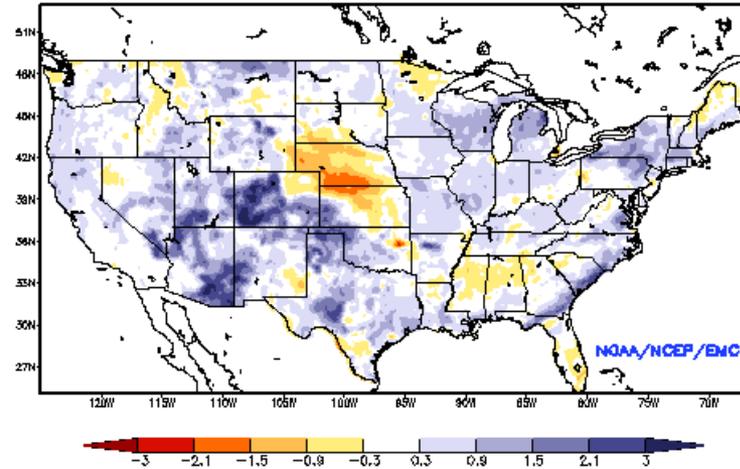
NCEP Noah - Current Evaporation Anomaly (mm/day)  
Valid: JUN 30, 2018



NCEP Noah - Current Evaporation Anomaly (mm/day)  
Valid: JUL 01, 2018



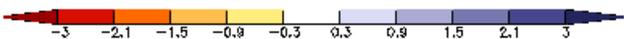
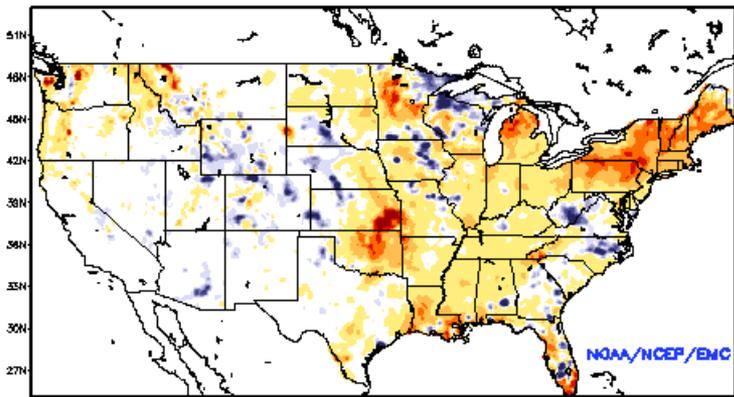
NCEP Noah - Current Evaporation Anomaly (mm/day)  
Valid: JUL 01, 2018



# Daily Total runoff comparison

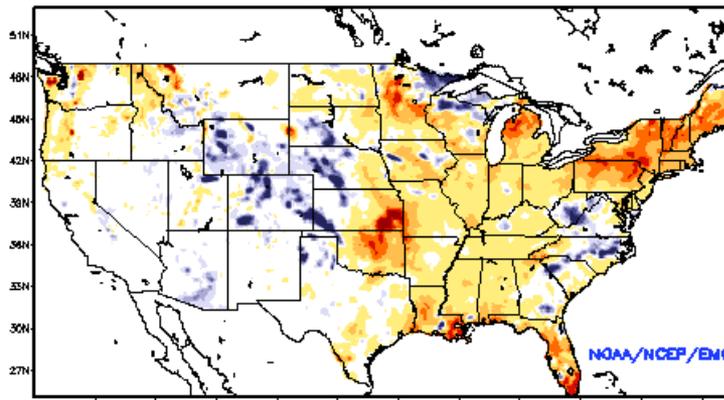
## OPS

NCEP Noah - Current Total Runoff Anomaly (mm/day)  
Valid: JUN 30, 2018

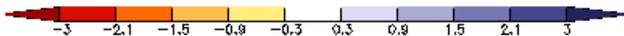
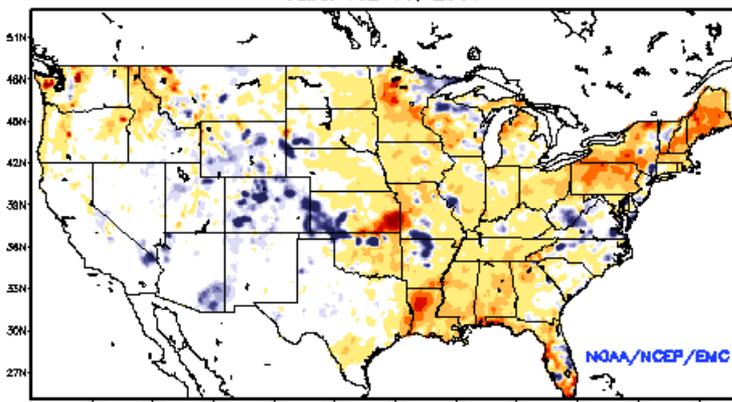


## Test

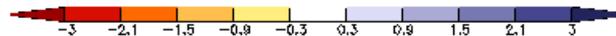
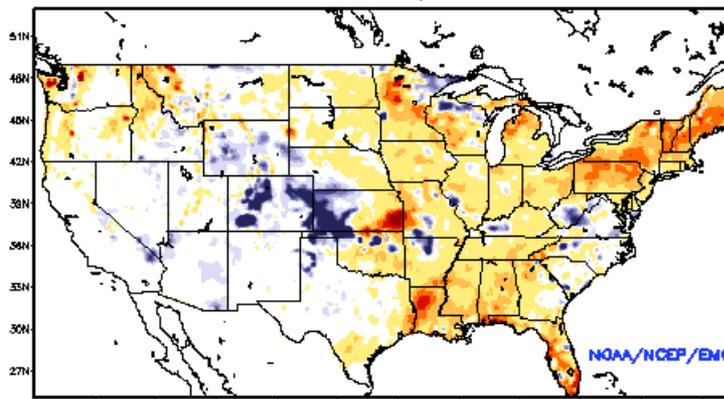
NCEP Noah - Current Total Runoff Anomaly (mm/day)  
Valid: JUN 30, 2018



NCEP Noah - Current Total Runoff Anomaly (mm/day)  
Valid: JUL 01, 2018



NCEP Noah - Current Total Runoff Anomaly (mm/day)  
Valid: JUL 01, 2018

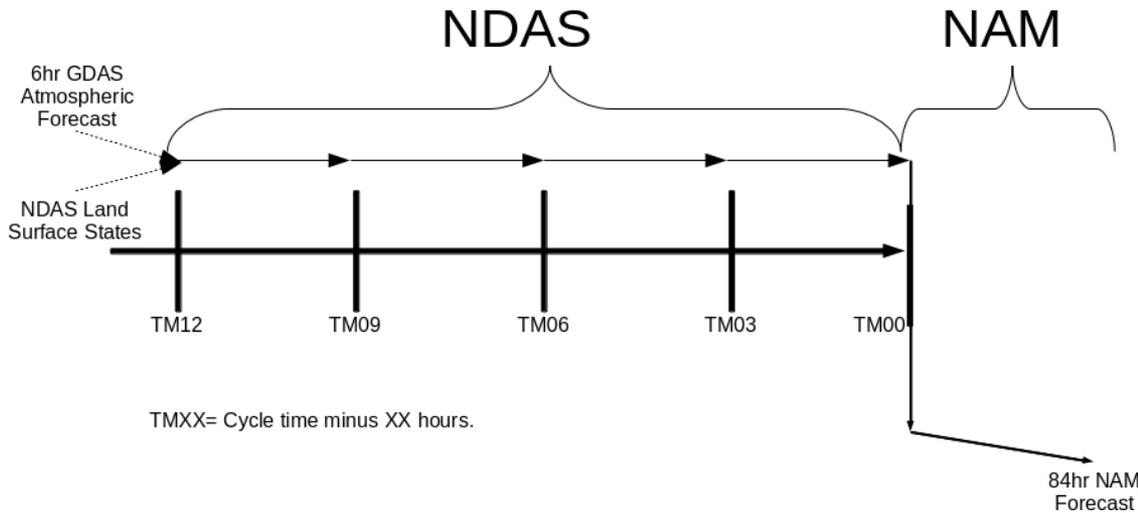


# Plan A

- a. Extend Noah and its routing to the other three models
- b. Combine current OPS system (codes and scripts) with real-time system (test version) into one system
- c. Cron job run in one system
- d. Stage experimental data to EMC LDAS website for internal users
- e. Test experimental realtime NLDAS drought monitor

# **NDAS and NAM Upgrade**

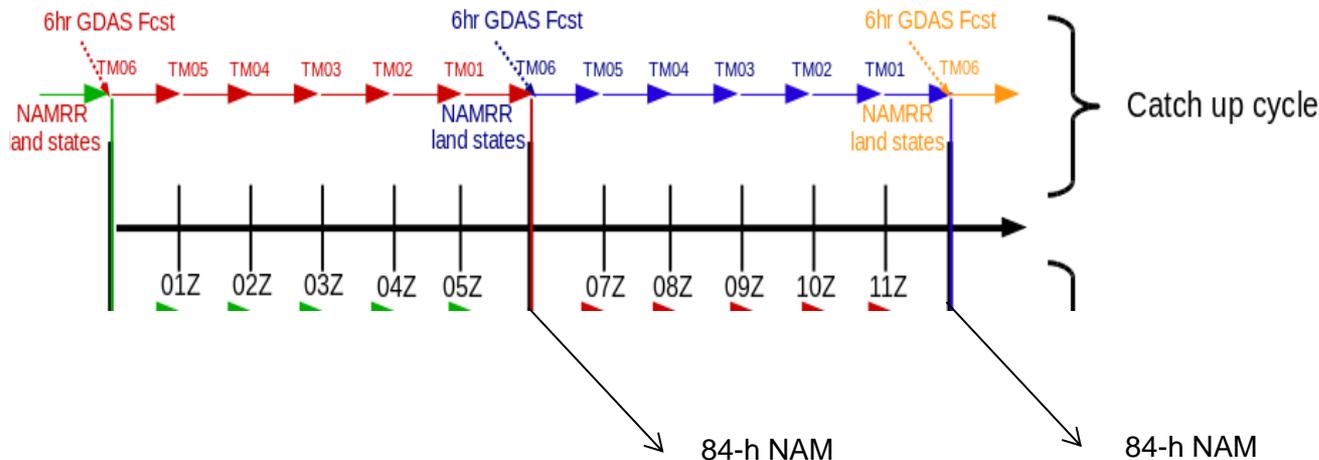
# 12-h NDAS vs 6-h NDAS “Catchup cycle”



**NDAS = 12-h; 12 km parent analysis, 3-h fcst**

Parallel NAM with this configuration = **NAMX** ; all model/analysis changes, uses ops NDAS/NAM data (NAM data dump at T+ 70 min)

4 cycles, hourly output

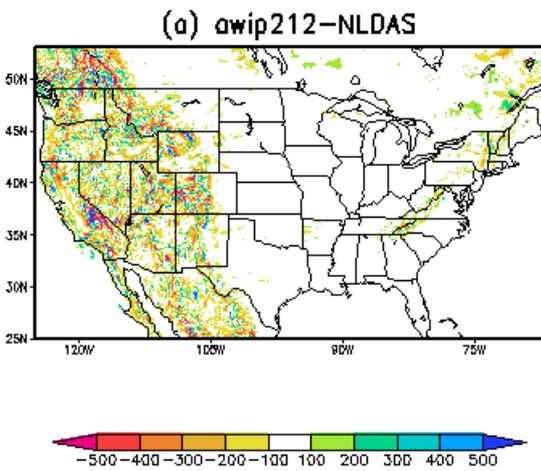


**NDAS = 6-h; 12km parent + 3 km CONUS/AK nest, 1-h fcst**

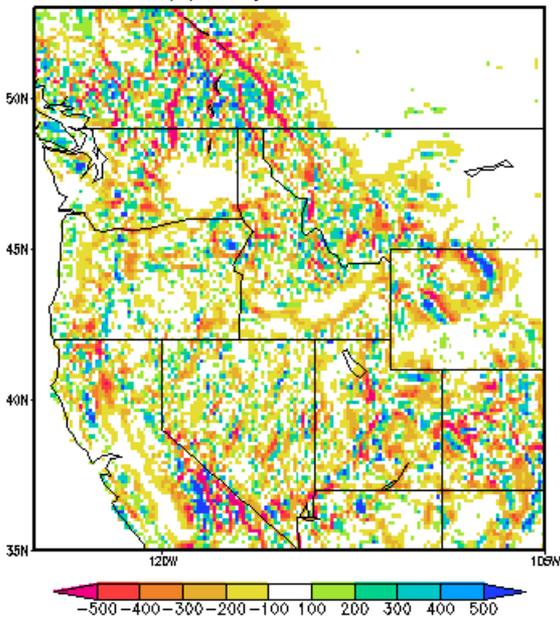
Parallel NAM with this configuration = **NAMRR** ; almost all model/analysis changes (differences will be noted); used RAP data dumps at T+ 30 min) since it was set up assuming it would be part of the hourly NAMRR

# Elevation Difference (m)

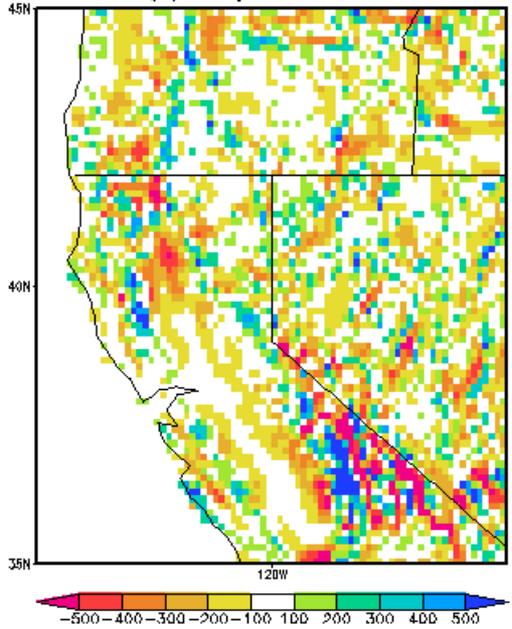
## NAM awip212



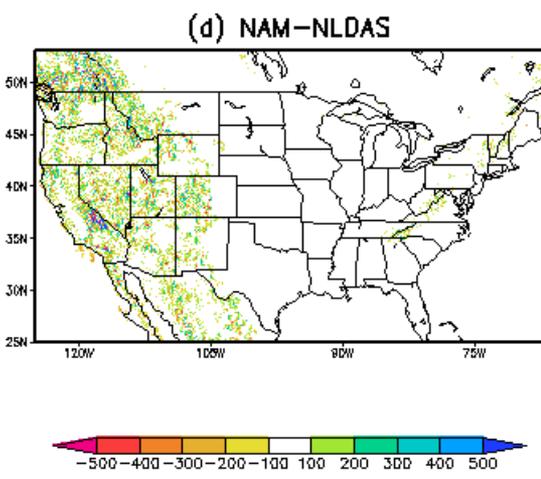
(b) awip212-NLDAS



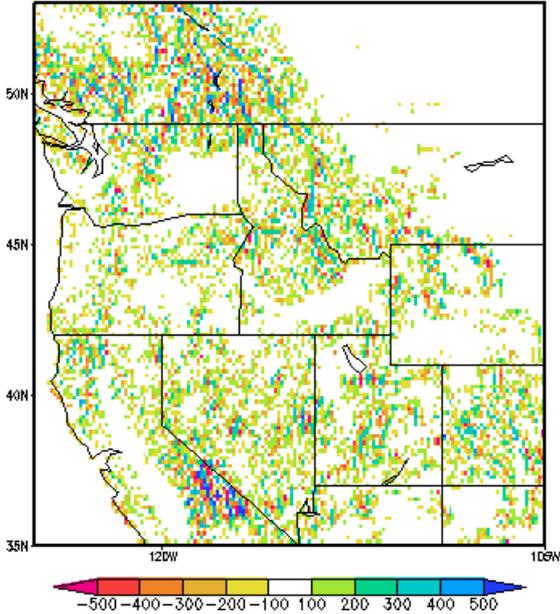
(c) awip212-NLDAS



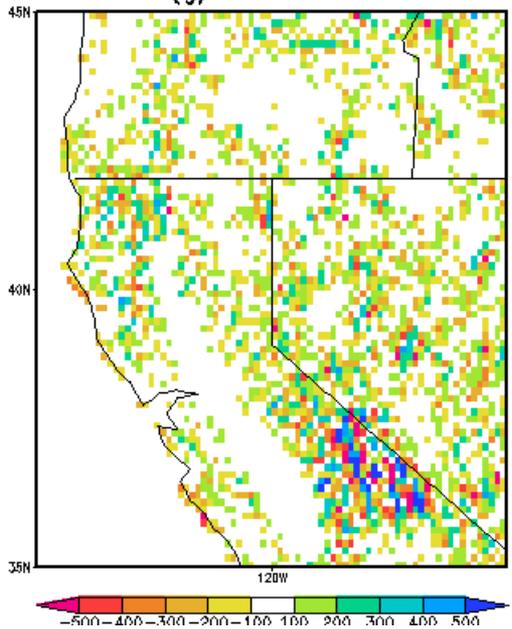
## NAM awldas



(e) NAM-NLDAS



(g) NAM-NLDAS



# Plan B

## New Scripts:

### Follow NAMX and NAMRR Upgrade

- a. NDAS (4 cycles run) and NAM data are directly used without spatial and temporal interpolation (awldas output)
- b. Read NDAS/NAM grib2 format directly**
- c. Use 13-60 hour NAM forecast to complete realtime product for today afternoon and tomorrow morning

# Open Discussion

- (1) MODIS IGBP vegetation type (will be used for next NCEP GFS and CFS upgrade). **Current OPS NLDAS used UMD vegetation type and will need to test MODIS to keep in the same page**
- (2) MODIS albedo (snow maximum and snow-free albedo) **Robinson and Kukla, 1985; AVHRR 5-year average monthly snow-free albedo**
- (3) VIRS weekly real-time greenness vegetation fraction from NESDIS **Monthly 5-year climatology GVF (Gutman and Ignatov, 1988)**
- (4) GLDAS-alike direct insert SWE or Snow Cover method (if we will transition LIS-based NLDAS as suggested by CTB proposal, it should include SNOW-DA and SM-DA part, do we still plan to go to GLDAS-alike method here?)
- (5) Soil data: **STATSGO-based is the same as GFS/CFS update. Do we want to test SSURGO soil type data?**

**Your Comments/Suggestions are very appreciated**

**Thank you**